Confidence of Agents and Market Frictions

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1 Introduction

1.1 Preferences and Business Cycles

From Keynes(1936) we know that behavior of consumer may be an important factor of business cycles. Prosperity is always associated with consumer boom and even today one of the element of the stimulation package were tax cuts, which assumed to increase consumption and, consequently, output. Gottfried Haberler in his book Prosperity and Depression points that business cycles are caused by sudden changes in behavior of households.

New generation of macroeconomic models brought by Kydland and Prescott(1982) couldn't consider behavioral shocks as a source of business cycle by very simple reason: in the labor market household preferences determine labor supply and firms provide market with labor demand, but change in labor supply generate negative comovement between wages and consumption on the one side, and employment on the other side. Beaudry and Portier give proof of the impossibility of Pigou cycles in standard one-sector models, using King, Plosser and Rebelo(1988) first order condition for labor supply. Partially this problem was fixed by introducing different sectors of the economy. Partially increasing number of decrease of freedom using adjustment cost to investment, capital and labor might also be helpful

This paper takes different approach. To keep things as simple as possible no adjustment costs and single-sector economy are assumed. Motivation for it comes from attacking Barro-King challenge, that the real wage multiplied by marginal utility of consumption is equal to marginal utility of leisure. This restriction is the one that causes consumption and employment to have positive comovement only in case of real wage increase. This restriction comes only from the labor supply side, thus we can hope that modification of this condition will give us necessary comovement. However, if single agent optimizing consumer is considered, then we are back to Beaudry and Portier(2004) impossibility proof. One of the solution would be to consider non-optimizing or optimizing non-rationally agent, in the way of Jaimovich and Rebelo (2007), another way is to consider different type of consumers and consider interactions between them. In the end this is what happens in reality, which is slightly more complicated because of intermediate institutions - like banks and mutual funds. In the absence of transaction costs they would disappear and the only things we would be left with are savers and borrowers.

Differentiation between different types of agents brings its own problems for expectation shocks. In the framework of rational expectation model everyone possess equal amount of information and this limits number of possible shocks. For example, it is important to notice that savers and borrowers often have asymmetric information position. Borrower needs money now and cares only about his debt and his ability to repay it. At the same time saver usually gives money to several different borrowers and cares more about general conditions of the economy.

First I will outline main equations of RBC model with savers and borrowers, then I will show that in this the model with only two types of agents improvement in confidence of investors will not generate positive comovement between consumption and employment. Then I will demonstrate a model with two type of borrowers and show that it has very nice properties. Model is very robust to variation of preference parameters of the households.

2 Model for two types of agents

2.1 Consumers

Consumer problem for savers is the following

$$maxE_0 \sum \beta^t (\frac{c_{st}^{1-\rho_1}}{1-\rho_1} - \frac{n_{st}^{\phi_1+1}}{\phi_1+1}) \tag{1}$$

$$c_t + c_{st} = W_t n_{st} + (1-\delta)K_{t-1} + R_{kt}K_{t-1} - s_t + R_{t-1}s_{t-1}; \tag{2}$$

By the same optimization problem for borrowers is:

$$maxE_0 (\sum \beta^t \frac{c_{bt}^{1-\rho_2}}{1-\rho_2} - \frac{n_{st}^{\phi_2+1}}{\phi_2+1}) \tag{3}$$

$$c_{bt} = W_t n_{bt} + b_t - R_{t-1}b_{t-1} + A_t; \tag{4}$$

Notice, compare to standard model budget constraint of borrowers has additional source of income A_t. It is a transfer that expected to be positive in the future. It is supposed to model confidence of savers, so that borrowers would clearly repay in the future and can borrow more. Equation for is the following $A_t = \epsilon_{t-10}$, where $\epsilon_t = \rho\epsilon_{t-1} + v_t$, where v_t is random noise.

$$R_t b_t \leq M W_t n_{bt}; \tag{5}$$

2.2 Firms

Firms maximize profits:

$$maxY_t - W_t L_t - R_{kt} K_t \tag{6}$$

Output is equal

$$Y_t = K_{t-1}^{\alpha} N_t^{1-\alpha} + A_t \tag{7}$$

Notice that in the output equation technology parameter is absent due to the fact, that expectation about technology affect savers decision not only from the position of creditors, but also from position of workers. The purpose of the paper, however, is to show "net effect" of the confidence.

2.3 Aggregation

$$C_t = c_{bt} + c_{st} \tag{8}$$

$$N_t = n_{bt} + n_{st} \tag{9}$$

2.4 Equilibrium. FOC.

2.4.1 Consumption

Euler equations:

$$\frac{1}{c_{st}^{\rho_1}} = \beta E[\frac{(R_{kt} + 1 - \delta)}{c_{st+1}^{\rho_1}}] \tag{10}$$

$$\frac{1}{c_{st}^{\rho_1}} = \beta E[\frac{R_t}{c_{st+1}^{\rho_1}}] \tag{11}$$

$$\frac{1}{c_{bt}^{\rho_1}} = \beta E[c_{bt+1}^{\rho_1} R_t] + \lambda R_t \tag{12}$$

2.4.2 Labor Supply

$$\frac{W}{c_{st}^{\rho_1}} = n_{st}^{\phi_1} \tag{13}$$

$$\frac{W}{c_{bt}^{\rho_2}} = n_{bt}^{\phi_2} + \lambda_t M W_t \tag{14}$$

2.4.3 Firm FOC

$$W_t = (1 - \alpha) \frac{Y_t}{n_{bt} + n_{st}} \tag{15}$$

$$R_{kt} = \alpha \frac{Y_t}{K_{t-1}} \tag{16}$$

2.4.4 Market Clearing

$$s_t = b_t \tag{17}$$

2.5 Simulation

In figures 1 and 2 we can observe that expected decrease in income of borrowers causes decrease in consumption and increase in employment. This result confirms standard RBC one agent model prediction, where households feel themselves poorer and decrease consumption and work more. In our two types case borrowers decrease consumption a little and do not tend to increase labor supply until the shock will hit, while savers behave as standard representative agent - they increase labor hours and decrease consumption, feeling poorer. So in aggregate we observe standard consequences of shift in labor supply.

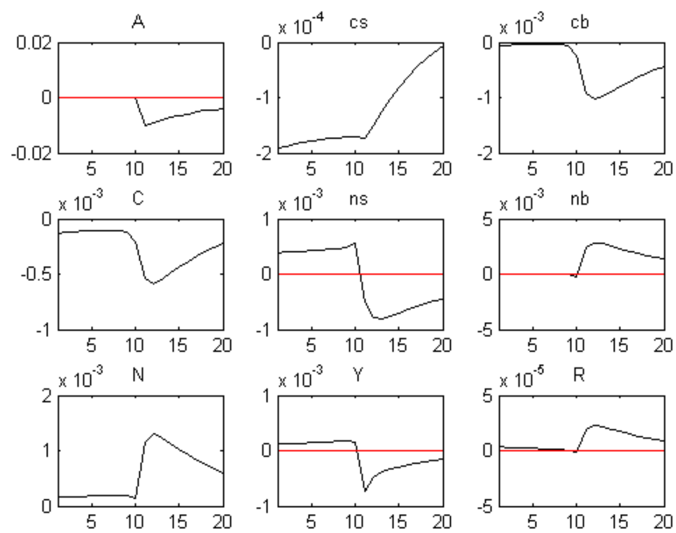

Figure 1: Expected Decrease in Income of Borrowers after 10 Periods

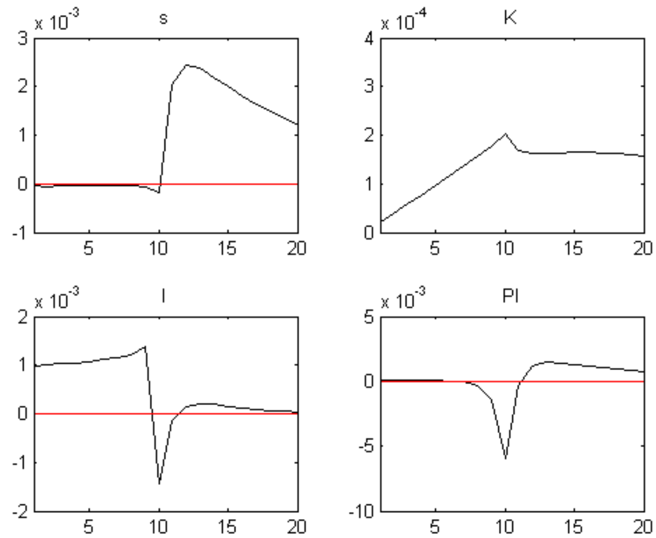

Figure 2: Expected Decrease in Income of Borrowers after 10 Periods

Therefore, consumer optimism and confidence cannot drive business cycle in the absence of adjustment costs standard neoclassical framework.

3 Two Types of Borrowers

Let's introduce additional type of borrower - cheater or bad borrower. Bad borrower just does not return money. He borrows as much as possible. He manages to borrow because savers doesn't observe, whether the borrower is good or not. In the model bad borrower is able to borrow in the next period, even if he doesn't return his current debt. Although this assumption is unrealistic, it can have interpretation from the following point of view: in reality debts should be repaid quite long time and many entrepreneurs are able to get additional credits when they know that it is impossible to repay their current debts. Indirectly this issue is described by given above assumption. Also it is important to notice that general debtor doesn't consider possibility of not repaying, and in the given framework good borrowers do not believe that they might not repay. Indirectly good borrowers are overoptimistic about their futures.

So optimization problem for the bad borrower is the following:

$$bb_t R_t = M n_{bbt} W_t \tag{18}$$

where R_t is the interest rate, bb_t - amount of debt, nbb_t - labor supply of the bad borrower, W - salary. He doesn't have Euler equation, since borrowing doesn't imply reduction of future consumption. However, modified budget constraint is still present.

$$c_{bbt} = W_t n_{bbt} + bb_t; \tag{19}$$

putting that equations into utility function gives

$$maxE_0 \sum \beta^t (\frac{c_{bbt}^{1-\rho_1}}{1-\rho_1} - \frac{n_{bbt}^{\phi_1+1}}{\phi_1+1}) = maxE_0 \sum \beta^t (\frac{(W_t n_{bbt} + bb_t)^{1-\rho_1}}{1-\rho_1} - \frac{n_{bbt}^{\phi_1+1}}{\phi_1+1}) \tag{20}$$

$$maxE_0 \sum \beta^t (\frac{(W_t n_{bbt} + M n_{bbt} W_t / R_t)^{1-\rho_1}}{1-\rho_1} - \frac{n_{bbt}^{\phi_1+1}}{\phi_1+1}) \tag{21}$$

then labor supply for bad borrowers is given by

$$\frac{W(1+M/R_t)}{c_{bbt}^{\rho_1}} = n_{bbt}^{\phi_1} \tag{22}$$

Existence of bad borrowers modifies Euler equation for savers:

$$\frac{1}{c_{st}^{\rho_1}} = \beta E_t[(1-P_{t+1})\frac{R_t}{c_{st+1}^{\rho_1}}] \tag{23}$$

Aggregation constraints also have to take into account bad borrowers.

$$C_t = (1-P_t)c_{bt} + P_t c_{bbt} + c_{st} \tag{24}$$

$$N_t = (1-P_t)n_{bt} + n_{st} \tag{25}$$

$$P_t = P_{t-1} + u_t \tag{26}$$

All other equations remain the same as in the standard saver-borrower problem. In the figures 3,4, and 5 consequences of unexpected increase of percentage of bad borrowers are shown. Output, capital and consumption are falling, while employment is slightly increasing, but it is still below the steady state (this case can be fixed by labor adjustment costs). Notice, that impulse response consider just one period rise of the percentage of bad borrowers and P_t doesn't follow AR process, being a random walk.

These changes happen as savers suddenly reduce lending, therefore, increase consumption. As a consequence investment began to fall, consumption is falling because good borrowers are not able to borrow as much as before. Reducing their consumption and debts they increase leisure, thus, labor supply is falling. Small investment lead to lower level of capital and gradual decrease of output.

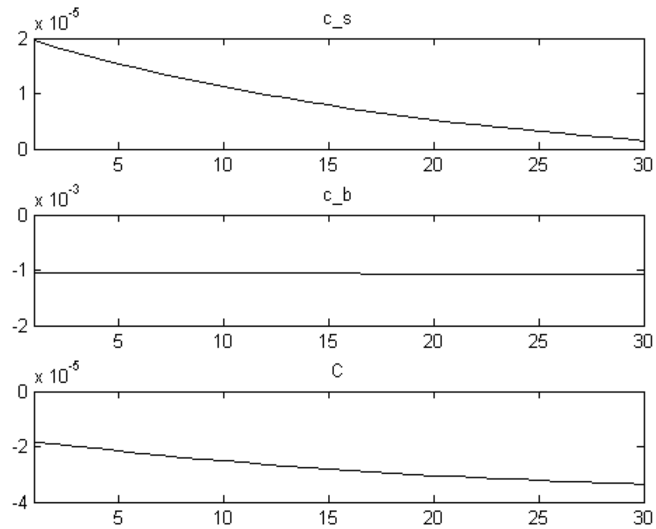

Figure 3: Unexpected Increase in Percentage of The Bad Borrowers

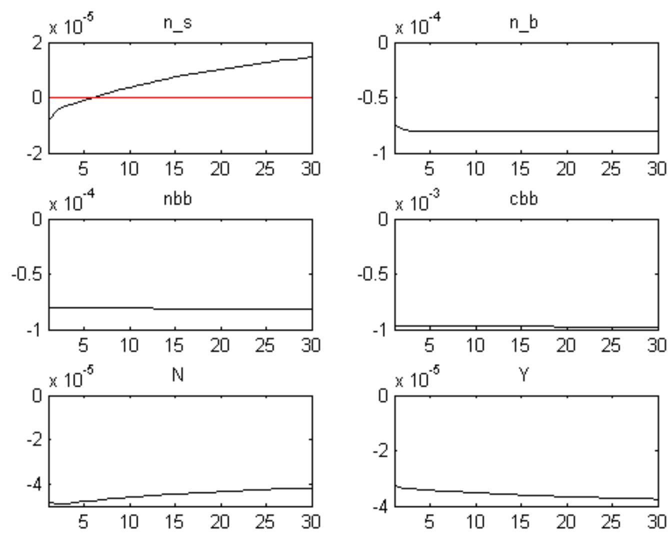

Figure 4: Unexpected Increase in Percentage of The Bad Borrowers

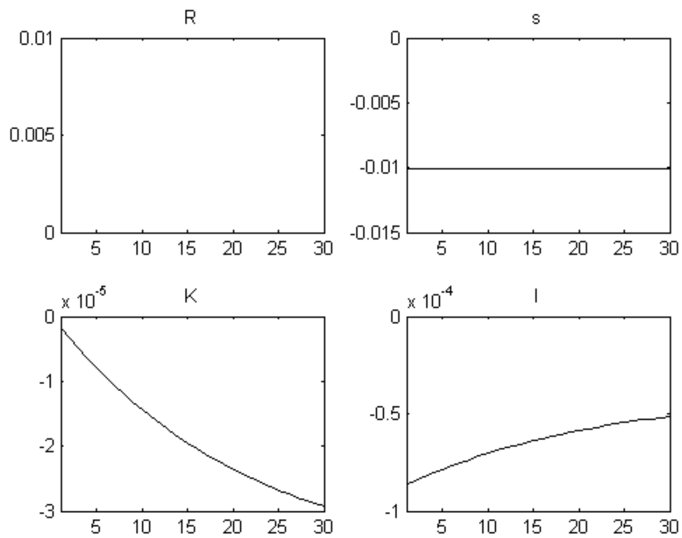

Figure 5: Unexpected Increase in Percentage of The Bad Borrowers

4 Expected Appearance of Bad Borrowers

In figures 6,7, and 8 below increase in the percentage of borrowers after 10 periods is described. Once this information becomes available, recession in the economy starts immediately. We observe decrease in employment, investment, output and capital, while consumption is first smooth and the decreasing. This fits well observed data.

Intuition is similar to actual increase of the bad borrowers. Savers increase their consumption and reduce savings and thus, consumption of borrowers and investment are falling. Borrowers consider consumption as more expensive and move to leisure, thus, labor is falling. The major driver of decrease in output is lower level of investment, which leads to decline in capital.

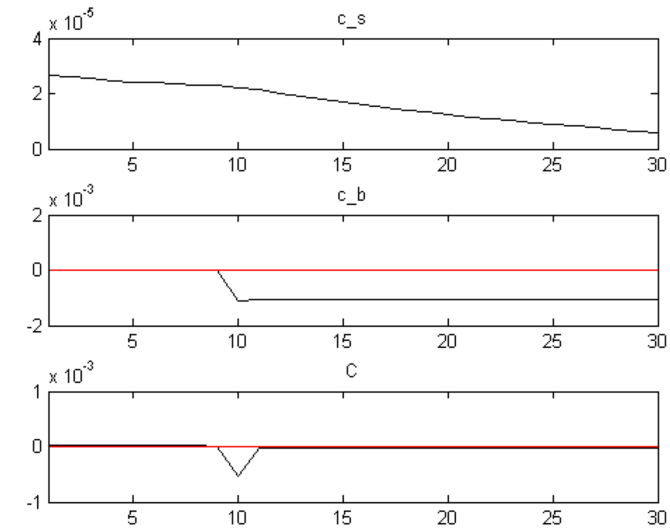

Figure 6: Expected Increase in Percentage of The Bad Borrowers After 10 Periods

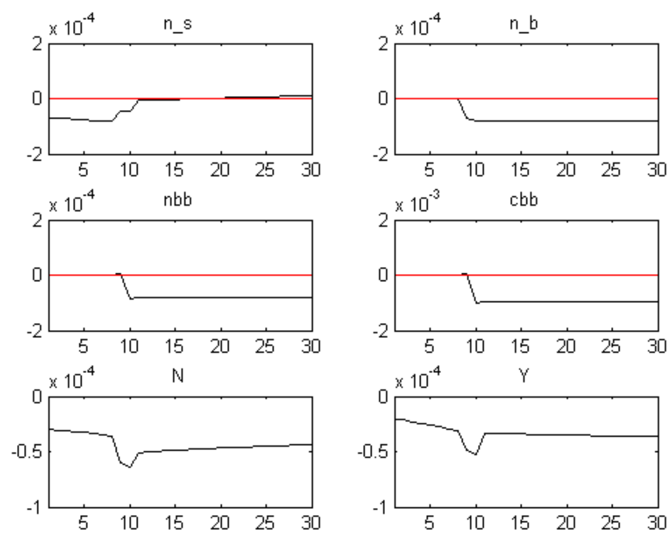

Figure 7: Expected Increase in Percentage of The Bad Borrowers After 10 Periods

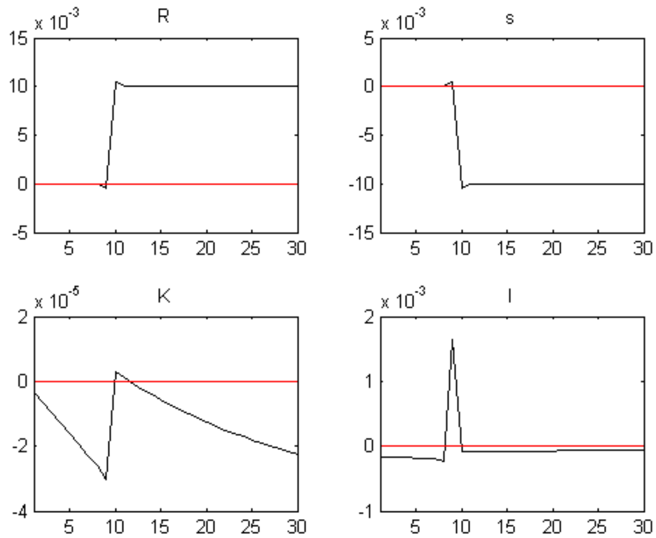

Figure 8: Expected Increase in Percentage of The Bad Borrowers After 10 Periods

5 Conclusion

This paper aimed at modelling business cycles after different demand shock under standard RBC one-sector economy without adjustment costs and with different type of consumers. This paper shows ways to overcome Barro-King challenge in the framework of asymmetric information between debtors and creditors, by showing that negative expectations about possibility of debtors running with the money might cause recession in the economy. This result is achieved through modelling "overconfidence" of borrowers, who don't increase their labor supply in the presence of negative expectations. In the example of just two types of consumers paper shows that labor supply increases and consumption decreases, result equivalent to the standard RBC model and one representative consumer.

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6 Appendix

6.1 Dynare Code for Bad Borrowers

```
var nbb cbb bb P K I c_s n_s  C N W n_b c_b s Y LAMBDA R R_k b A  ;
varexo u ;

parameters BETA_S, BETA_B, RHO, SIGMA, DEPR,BORCON, WEL1, WEL2,RHO1, RHO2, KAPS ;

KAPS = 0.33;    // Elasticity of output with respect to capital
BETA_S  = 0.99;    // Discount factor for savers
BETA_B = 0.90 ;   // Discount factor for borrowers
RHO   = 0.90;    // Autoregressive coefficient of technology innovation
SIGMA = 0.01;
DEPR = 0.02;    // Rate of depreciation
RHO1 = .90;
RHO2 = .90;
BORCON =0.1;          // Fraction of current income borrowers can borrow. Made small so that
WEL1 = .20;        // Elasticity of wages with respect to hours
WEL2 = .20;



model;

 // SAVERS Budget constraint
exp(K)+ exp(c_s) = exp(W)*exp(n_s)+(1-DEPR)*exp(K(-1))+exp(R_k)*exp(K(-1))-exp(s)+
+(1-P)*exp(R(-1))*exp(s(-1));
// SAVERS Euler equation for capital
1/exp(c_s)^RHO1=(BETA_S/(exp(c_s(+1))^RHO1))*(exp(R_k)+1-DEPR);
 // Labor Supply for savers
exp(W)/exp(c_s)^RHO1 = exp(n_s)^WEL1;
// Euler equation for lending
1/exp(C)^RHO1 = BETA_S*(1-P(+1))*exp(R)/exp(C(+1))^RHO1;

// Borrowing Constraints for Borrower
exp(R)*exp(b) = BORCON*exp(W)*exp(n_b);
 // Labor supply for borrowers
exp(n_b)^WEL2= exp(W)/exp(c_b)^RHO2 + exp(LAMBDA)*BORCON*exp(W);
 // Euler equation for borrowing
1/exp(c_b)^RHO2 = BETA_B*exp(R)/(exp(c_b(+1))^RHO2) + exp(LAMBDA)*exp(R);
 // Budget constraints for borrowers.
exp(c_b) = exp(W)*exp(n_b) + exp(b)- exp(R(-1))*exp(b(-1));

// Borrowing Constrain for bad Borrower
exp(R)*exp(bb) = BORCON*exp(W)*exp(nbb);
```

```
// Labor supply for bad borrower
exp(nbb)^WEL2= exp(W)*(1+BORCON/exp(R))/exp(cbb)^RHO2;
  // Budget constraing for bad borrower

exp(cbb) = exp(W)*exp(nbb) + exp(bb);



// Market clearing
(1-P)*exp(b)+P*exp(bb) = exp(s);

//exp(W) = (1-KAPS)*exp(A)*(exp(K(-1))^KAPS)*(exp(n_s) + exp(n_b))^(-KAPS);
//exp(R_k) = KAPS* exp(A)*(((exp(n_s) + exp(n_b))/exp(K(-1)))^(1-KAPS));

//PRODUCTION FUNCTION
exp(Y) = exp(K(-1))^KAPS*(exp(n_s)+(1-P)*exp(n_b)+P*exp(nbb))^(1-KAPS);
//CAPITAL ACCUMULATION
exp(I) = exp(K(+1))-(1-DEPR)*exp(K);

// Labor demand equation
exp(W) = (1-KAPS)*exp(Y)/(exp(N));
  // INTEREST RATE
exp(R_k) = KAPS*exp(Y)/exp(K(-1));
 // Aggregate Consumptiom
exp(C) = exp(c_s) + (1-P)*exp(c_b)+P*exp(cbb);
  // Aggregate labor hours
exp(N) = exp(n_s) + (1-P)*exp(n_b)+P*exp(nbb);


A =A(-1) + u;
P=A(-10);
end;

initval;
Y = 0;
W = 0;
A = 0;
K = 0;
I = 0;
end;

steady;

shocks;
var u; stderr SIGMA ;
end;
```

```
stoch_simul(periods=1000,order=1,irf=30) A c_s c_b C;
stoch_simul(periods=1000,order=1,irf=30) n_s n_b nbb cbb N Y;
stoch_simul(periods=1000,order=1,irf=30) R s K I;
```